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U.S. Department of Energy
Idaho Operations Office

Institutional Controls Status Report for the Power Burst Facility and Auxiliary Reactor Area, Operable Unit 5-12, for the Year 2002

INEEL
Idaho National Engineering and Environmental Laboratory
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Prepared for the
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ABSTRACT

This institutional controls status report for the Power Burst Facility and Auxiliary Reactor Area addresses the current status of institutional control measures required by the Operable Unit (OU) 5-12 Record of Decision. This report includes a record of recent inspections, site histories, brief profiles of contaminants, and summaries of future actions for OU 5-12. An institutional control plan has been developed for OU 5-12 that defines the improvements and adjustments required to ensure the continued protection of human health and the environment at OU 5-12 sites.

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ACRONYMS

ARA	Auxiliary Reactor Area
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CFA	Central Facilities Area
D&D	decontamination and dismantlement
DOE	Department of Energy
DOE-ID	Department of Energy Idaho Operations Office
ICDF	INEEL CERCLA Disposal Facility
IDAPA	Idaho Administrative Procedures Act
INEEL	Idaho National Engineering and Environmental Laboratory
OU	operable unit
PBF	Power Burst Facility
PCB	polychlorinated biphenyl
RA	remedial action
ROD	Record of Decision
RWMC	Radioactive Waste Management Complex
RWP	radiological work permit
SL-1	Stationary Low-Power Reactor No. 1
SPERT	Special Power Excursion Reactor Test
SSA	Storage and Staging Annex
TSCA	Toxic Substances Control Act
WAG	waste area group
WERF	Waste Experimental Reduction Facility

Institutional Controls Status Report for the Power Burst Facility and Auxiliary Reactor Area, Operable Unit 5-12, for the Year 2002

1. INTRODUCTION

This institutional controls status report describes the measures currently being taken to ensure the protection of human health and the environment at sites within the Power Burst Facility (PBF) and Auxiliary Reactor Area (ARA) at the Idaho National Engineering and Environmental Laboratory (INEEL). These sites were identified in *Final Record of Decision for Power Burst Facility and Auxiliary Reactor Area* (Department of Energy Idaho Operations Office [DOE-ID] 2000a) as Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) (42 USC 9601 et seq.) release sites for Waste Area Group (WAG) 5. PBF contains five separate operational facilities, and the ARA historically comprised four separate facilities. Together, the ARA and PBF areas contain 55 individual release sites. There are 15 sites within Operable Unit (OU) 5-12 that were identified in the Record of Decision (ROD) (DOE-ID 2000a) as requiring institutional controls. Six of these 15 sites are also identified as requiring remediation in accordance with this ROD. A map of the INEEL delineating the location of WAG 5 is presented in Figure 1-1.

The need for institutional controls following remediation will be established by postremediation sampling. The remaining 40 sites have been identified as "No Action" where institutional controls will not be required. An institutional control plan has been developed as part of *Operations and Maintenance Plan for Power Burst Facility and Auxiliary Reactor Area, Operable Unit 5-12* (DOE-ID 2000b). The institutional controls plan defined any modifications or changes needed at these sites to protect human health and the environment. The operations and maintenance plan (DOE-ID 2000b) was provided as an attachment to *Waste Area Group 5 Remedial Design/Remedial Action Work Plan, Phase II* (DOE-ID 2000c).

The remedial action for WAG 5 has been divided into two phases. Phase I is specific to tanks and inactive waste systems located at ARA and is outlined in the *Waste Area Group 5 Remedial Design/Remedial Action Work Plan, Phase I* (DOE-ID 2001a). Phase II is concerned with the remediation of contaminated soils located at both ARA and PBF and is covered under the *Waste Area Group 5 Remedial Design/Remedial Action Work Plan, Phase II* (DOE-ID 2000c). Because the proximity of some components of one of the tank sites (ARA-16) to one of the soil sites (ARA-25), the remediation of the ARA-25 soils was completed as part of the Phase I activities. The Phase I remedial action was conducted during the 2000 and 2001 field seasons. The Phase II remedial activities will be conducted beginning in 2003 to coincide with the opening of the INEEL CERCLA Disposal Facility (ICDF).

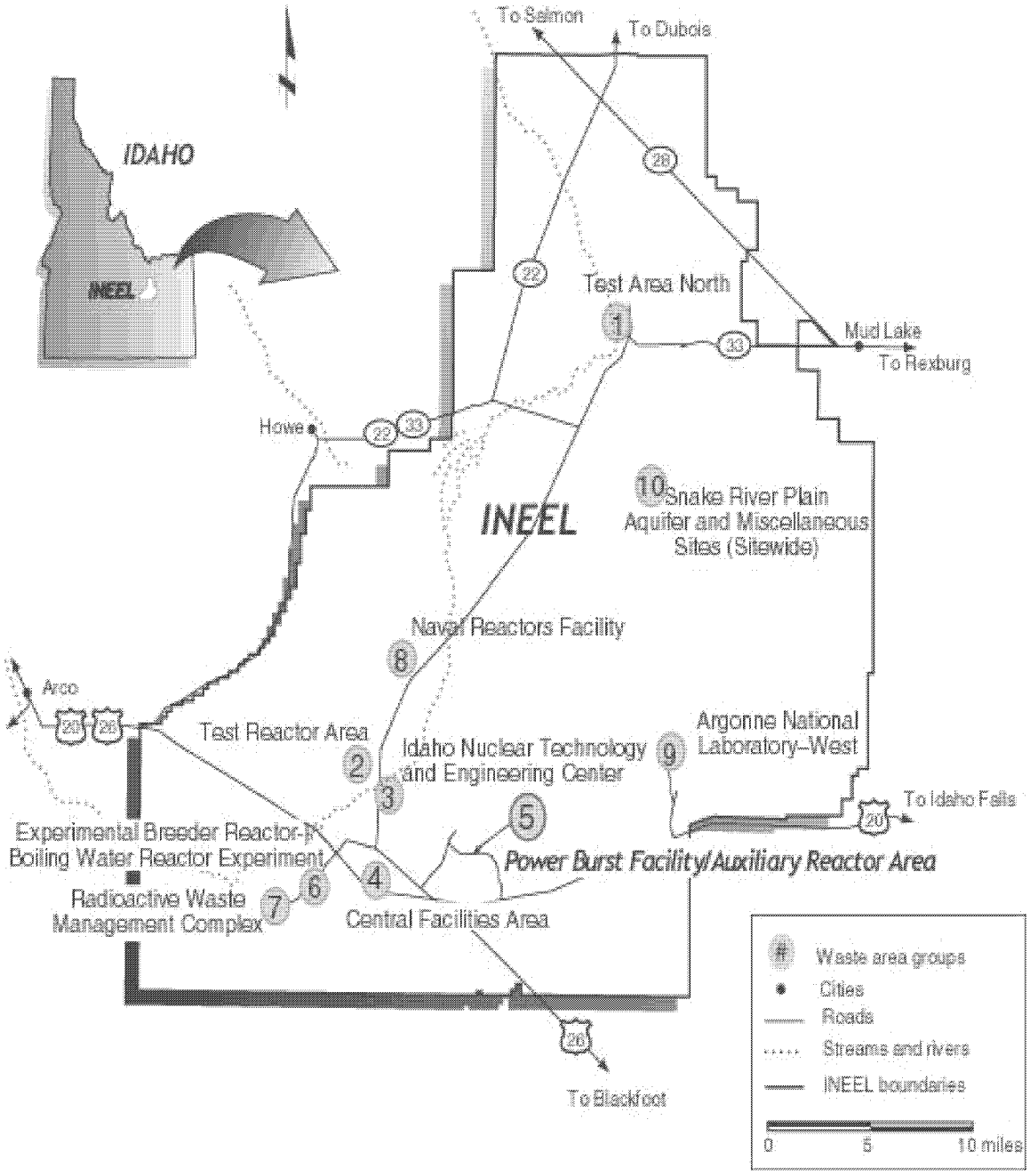

Figure 1-1. Location of WAG 5 at the INEEL.

2. SITE HISTORY AND ENFORCEMENT ACTIVITIES

2.1 INEEL History

The INEEL, originally established in 1949 as the National Reactor Testing Station, is a Department of Energy (DOE)-managed reservation that historically has been devoted to energy research and related activities. The National Reactor Testing Station was redesignated as the Idaho National Engineering Laboratory in 1974 to reflect the broad scope of engineering activities that were being conducted at various laboratory facilities. In 1997, the Idaho National Engineering Laboratory was redesignated as the Idaho National Engineering and Environmental Laboratory in keeping with contemporary emphasis on environmental research.

Historically, facilities at the INEEL were dedicated to the development and testing of peaceful applications for nuclear power. Throughout the 50 years of INEEL operations, disposal practices have been implemented in compliance with state and federal regulations as well as policies established by DOE and its predecessors. Some of these practices are not acceptable by contemporary standards and have been discontinued. Contaminated structures and environmental media, such as soil and water, are the legacy of some historical disposals. Occasional accidental releases also have occurred over time. In keeping with the contemporary emphasis on environmental issues, INEEL research is now focused on environmental restoration to address these contaminated media and waste management issues to minimize additional contamination from current and future operations. As described in *INEEL Comprehensive Facility and Land Use Plan* (DOE-ID 2001b), the emphasis of work at the INEEL is moving toward managing radiological and hazardous waste, restoring the environment, developing environmental cleanup technologies, preserving national security, and developing of nuclear technologies and applications.

2.2 WAG 5 History

As shown in Figure 2-1, ARA and PBF are located in fairly close proximity. In addition to location, the two areas have similar operational backgrounds and sources of contamination. Therefore, ARA and PBF were consolidated into one waste area group, WAG 5, for comprehensive evaluation under the *Federal Facility Agreement and Consent Order* (DOE-ID 1991). A synopsis of the history for each facility is given below.

2.2.1 Auxiliary Reactor Area

The ARA-I and ARA-II facilities were constructed in 1957. The ARA-I facility was built to support the Stationary Low-Power Reactor No. 1 (SL-1) located in the adjacent ARA-II facility and was the staging area for the emergency response to the 1961 SL-1 reactor accident and cleanup. The SL-1 reactor at ARA-II was operated intermittently from August 1958 until it was destroyed by a nuclear accident in January 1961 (Holdren, Filemyr, and Vetter 1995). Subsequent to decontamination following the SL-1 accident, activities at ARA-I included hot cell operations, materials research, and laboratory operations, including sample preparation and inspection. The main buildings at ARA-II were converted to offices and welding shops. The ARA-II facility also housed numerous minor structures such as a guardhouse, a well house, a chlorination building, a decontamination and laydown building, a power extrapolation building, an electrical substation, and several storage tanks. The ARA-I and ARA-II facilities were formally shut down in 1988 and 1986, respectively. Decontamination and complete dismantlement of the ARA-I and ARA-II facilities were initiated in 1995. These activities are documented in "Final Report of the Decommissioning and Dismantlement of the Auxiliary Reactor Area I Facility" (INEEL 2000) and "Final Report of the Decontamination and Dismantlement of the Auxiliary Reactor Area II Facility" (INEEL 1999a).

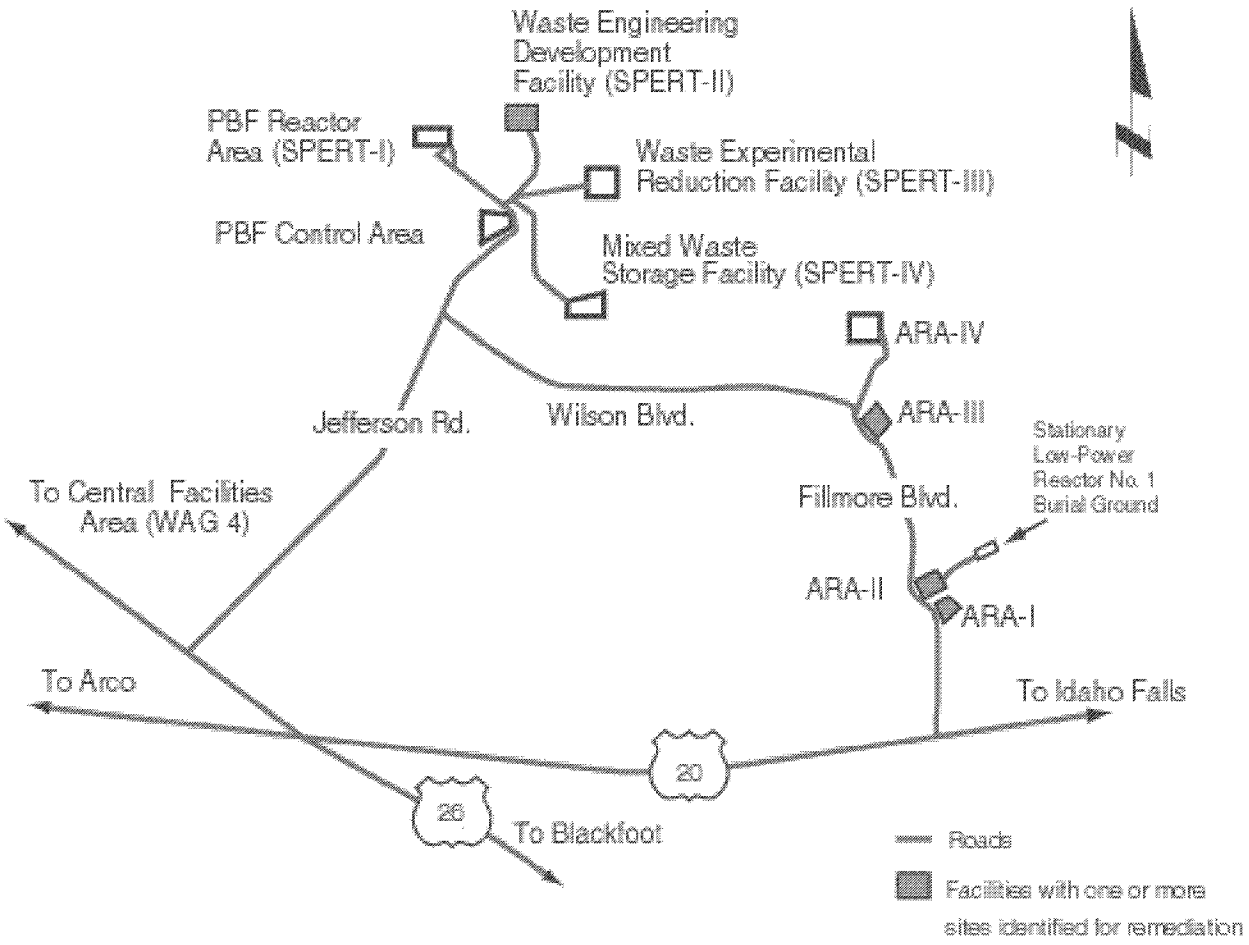

Figure 2-1. Physical configuration of WAG 5.

Construction of the ARA-III facility was completed in 1959 to house the Army Gas-Cooled Reactor Experiment research reactor. Experiments with the reactor continued until the plant was deactivated in 1961. In 1963, the ARA-III facility was modified to support the Mobile Low-Power Reactor series of tests conducted at the ARA-IV facility. The ARA-III facility remained active until late 1965, when the Army Reactor Program was phased out. In 1969, two buildings were constructed at ARA-III to provide additional laboratory and office space in support of other INEEL programs. The facility was shut down in 1989. Decontamination and complete dismantlement were initiated in 1990 and completed in 1999. These activities were documented in the "Final Report—Decontamination and Decommissioning for Auxiliary Reactor Area-III" (INEEL 1999b).

The ARA-IV facility was built to accommodate the Mobile Low-Power Reactor 1, an active project from 1957 to 1964. The Nuclear Effects Reactor was operated at ARA-IV from 1967 to 1970. The area was closed down until 1975, at which time it was used temporarily for some welding qualification work. Decontamination and dismantlement were performed in 1984 and 1985. These activities have been documented in the *Final Report – Decontamination and Decommissioning of the Auxiliary Reactor Area IV Facility* (EG&G 1988). A small control building, a bunker, a sanitary waste system, and the buried remains of two leach pits are all that remain. Since 1985, the area has been used occasionally for testing explosives in powdered-metal manufacture experiments.

2.2.2 Power Burst Facility

The PBF Control Area was originally built in the late 1950s for remote control of the Special Power Excursion Reactor Test (SPERT) experiments. As shown in Figure 2-1, the PBF Control Area is centrally located relative to the four SPERT facilities that surround it. The PBF Control Area was greatly expanded for the PBF program, but the area's primary function as a support facility has not changed. It provides raw water storage and distribution, administrative offices, instrument and mechanical work areas, and data acquisition resources.

The SPERT-I reactor was operated from 1955 to 1964, was decommissioned in 1964, and was demolished in 1985. Remnants of the original SPERT-I facility, which consist of a small terminal building, a small instrument cell, some decomposing pavement, an abandoned seepage pit, and an old leach pond, remain in the vicinity. The PBF reactor was constructed in 1972 just north of the remains of the SPERT-I facility. The PBF reactor has been on standby since 1985. Other structures include a maintenance and storage building, cooling towers, two electrical substations, and numerous smaller buildings and structures.

The Waste Engineering Development Facility, originally built to contain the SPERT-II reactor, was constructed in the late 1950s. The SPERT-II reactor was operational from 1960 to 1964. After the reactor was removed, the facility was converted for research purposes. Current activities include waste treatment development and laboratory operations. A guardhouse is the only other building at the facility. An electrical substation, a leaching pond, a seepage pit, and a couple of underground tanks are the only other structures. The area is also used for temporary storage of uncontaminated lead. The lead is stored outside in cargo containers stacked on asphalt pads.

The SPERT-III reactor was built in the late 1950's and operational from 1958 to 1968. The reactor building was decontaminated in 1980, and the building was modified to contain the Waste Experimental Reduction Facility (WERF), which began operation in 1982. Operations at WERF involved volume reduction of low-level radioactive waste. In addition to the WERF building, the facility contains a metal processing facility, a waste storage and handling building, an electrical substation, two exhaust stacks, and underground tanks.

The Mixed Waste Storage Facility originally housed the SPERT-IV reactor, which was operational from 1961 to 1970. After the reactor was removed, the building was modified slightly and converted to a waste storage facility. Mixed low-level waste, including radioactively contaminated polychlorinated biphenyl (PCB) waste, is stored in the former reactor pit. The facility also contains an electrical substation, a leach pond, and underground tanks.

2.3 INEEL Comprehensive Facility and Land Use Plan

Land-use projections in *INEEL Comprehensive Facility and Land Use Plan* (DOE-ID 2001b) incorporate the assumption that the INEEL will remain under government management and control for at least the next 100 years. A mix of land uses across the INEEL is anticipated to include unrestricted industrial uses, government-controlled industrial uses, unrestricted areas, controlled areas for wildlife management and conservation, and waste management areas. No residential development will be allowed within INEEL boundaries, and no new major private developments (residential or nonresidential) on public lands are expected in areas adjacent to the INEEL site. Grazing will be allowed to continue in the buffer area. The plan includes specific land-use information about the PBF and ARA facilities, and this information will be updated as needed to reflect land-use changes.

3. INSTITUTIONAL CONTROLS

The 55 potential release sites at ARA and PBF were evaluated in *Waste Area Group 5, Operable Unit 5-12 Comprehensive Remedial Investigation/Feasibility Study* (Holdren et al. 1999). Seven sites were determined to pose an unacceptable risk to human health or the environment and were presented in the ROD (DOE-ID 2000a) as requiring remediation, as outlined in the *Waste Area Group 5, Operable Unit 5-12, Power Burst Facility and Auxiliary Reactor Area, Remedial Design/Remedial Action Scope of Work* (DOE-ID 2000d).

One of the seven sites, PBF-16, was to be remediated to address ecological risks only and would not require institutional controls. Based on the results of preremediation sampling conducted in FY 2000, it was determined that mercury contamination levels were actually below those reported in the ROD (DOE-ID 2000a). As discussed in the *Waste Area Group 5 Remedial Design/Remedial Action Work Plan, Phase* II (DOE-ID 2000c), the additional analytical results indicated that the actual mercury concentrations were below the remediation goal of 0.5 mg/kg. Therefore, the site is no longer considered an unacceptable risk, and no additional remediation of the site is required.

Institutional controls were identified as an additional component to the selected remedies at the remaining six sites requiring remediation. The need for institutional controls following remediation is determined based on postremediation sampling. Nine additional sites, while not presenting a risk at levels requiring remediation, still had contamination present at levels that precluded unrestricted use. The institutional controls will be maintained until it is determined during a five-year review that controls are no longer necessary and to ensure that site conditions have not changed significantly with the status of each site remaining consistent with the ROD (DOE-ID 2000a). In addition to the sites identified in the ROD (DOE-ID 2000a) as requiring institutional controls, two additional sites (ARA-07 and ARA-08) have subsequently been identified following completion of the Phase I remedial activities. The need for institutional controls at these two sites is discussed in the *Remedial Action Report for WAG 5, OU 5-12 Phase I Remedial Action; Sites ARA-02, ARA-16, ARA-25, and Inactive Waste System Sites ARA-07, ARA-08, ARA-13, and ARA-21* (DOE-ID 2002), Section 7.4.

The sites at the PBF and ARA areas listed in the ROD as requiring institutional controls as a component of the remedial action or long-term institutional controls are presented in Table 3-1. The table also includes ARA-07 and ARA-08 as discussed above and summarizes the current status of the institutional controls for each site as of July 2002. Details on site location, history, remedial action, and the institutional control at each location are presented in Appendix A.

Table 3-1. Summary of institutional control sites.

Site Code	Description	ROD Selected Remedy	Current Status
ARA-01	ARA-I Chemical evaporation pond	Remedial action/ institutional controls	Contains CERCLA sign, radiological fencing, soil contamination area signs; requires entry through main INEEL gate; and requires radiological work permit (RWP) for entry onto site.
ARA-02[a]	ARA-I Sanitary waste system	Remedial action/ institutional controls	Remedial action completed. Contains CERCLA sign, radiological fencing, soil contamination area signs; requires entry through main INEEL gate; and requires RWP for entry onto site.

Table 3-1. (continued).

Site Code	Description	ROD Selected Remedy	Current Status
ARA-03[b]	ARA-I Lead sheeting pad near ARA-627	Institutional controls	Contains CERCLA sign, radiological fencing, soil contamination area signs; requires entry through main INEEL gate; and requires RWP for entry onto site.
ARA-06	ARA-II SL-1 Burial ground	Institutional controls	Contains CERCLA sign, permanent markers, chain link fencing, soil contamination area signs; requires entry thropugh main INEEL gate; and requires RWP for entry onto site.
ARA-07	ARA-II Seepage pit to east (ARA-720A)	No action	Contains CERCLA sign and requires entry through main INEEL gate.
ARA-08	ARA-II Seepage pit to west (ARA-720B)	No action	Contains CERCLA sign, requires entry through main INEEL gate, and requires RWP for entry onto site.
ARA-12	ARA-III Radioactive waste leach pond	Remedial action/ institutional controls	Contains CERCLA sign, radiological fencing, soil contamination area signs; requires entry through main INEEL gate; and requires RWP for entry onto site.
ARA-16[a]	ARA-I Radionuclide tank	Remedial action/ institutional controls	Remedial action completed. Contains CERCLA sign, radiological roping, and soil contamination area signs; requires entry through main INEEL gate; and requires RWP for entry onto site.
ARA-23	ARA-II Radiologically contaminated surface soils around ARA-I and ARA-II	Remedial action/ institutional controls	Contains CERCLA sign, radiological fencing, and soil contamination area signs; requires entry through main INEEL gate; and requires RWP for entry onto site.
ARA-24	ARA-III Windblown soil	Institutional controls	Contains CERCLA sign, no fencing required, permanent marker installed, and requires entry through main INEEL gate.
ARA-25[c]	ARA-I Soils beneath the ARA-626 hot cells	Remedial action/ institutional controls	Remedial action completed. Contains CERCLA sign, radiological roping and soil contamination area signs; requires entry through main INEEL gate; requires RWP for access to site; and a monument will be installed marking the location of subsurface contamination remaining at the site following completion of the remediation of the ARA-23 site which encompasses ARA-25.

Table 3-1. (continued).

Site Code	Description	ROD Selected Remedy	Current Status
PBF-10	PBF Reactor area evaporation pond (PBF-733)	Institutional controls	Contains CERCLA sign, permanent marker installed, and requires entry through main INEEL gate and PBF facility gate.
PBF-12	PBF SPERT-I Leach pond	Institutional controls	Contains CERCLA sign, permanent marker installed during decontamination and dismantlement (D&D), and requires entry through main INEEL gate and PBF facility gate.
PBF-13	PBF Reactor area rubble pit	Institutional controls	Contains CERCLA sign, permanent marker installed, and requires entry through main INEEL gate and PBF facility gate.
PBF-21	PBF SPERT-III Large leach pond	Institutional controls	Contains CERCLA sign, permanent marker installed during D&D, and requires entry through main INEEL gate and PBF facility gate.
PBF-22	PBF SPERT-IV Leach pond (PBF-758)	Institutional controls	Contains CERCLA sign, radiological fencing, soil contamination area signs; requires entry through main INEEL gate and PBF facility gate, and requires RWP for access to site.
PBF-26	PBF SPERT-IV Lake	Institutional controls	Contains CERCLA sign and requires entry through main INEEL gate and PBF facility gate.

a. Contaminated surface soils attributed to, and will be removed as part of, the ARA-23 site remediation.

b. This site is located within the boundaries of the ARA-23 contaminated soils. As such, the site may be remediated as a result of the ARA-23 site remediation.

c. Contaminated soil was removed to basalt in accordance with the ROD. Residual contamination remains in the basalt.

4. WAG 5 ACTIVITIES

This section discusses the directives of the WAG 5 ROD (DOE-ID 2000a), the status of remedial activities at WAG 5, and the current status and disposition of WAG 5 waste streams generated as a result of past and ongoing activities.

4.1 WAG 5 ROD Directives

Because the components of the selected remedy for WAG 5 may result and have resulted in hazardous substances, pollutants, or contaminants remaining in WAG 5 above levels that allow for unlimited use and unrestricted exposure, the WAG 5 ROD (DOE-ID 2000a) requires that a statutory review be conducted within five years of initiating the remedial action to ensure that the remedy is, or continues to be, protective of human health and the environment.

Most remediation goals are based on soil concentrations equivalent to a risk of 1E-04 (1 in 10,000) to a hypothetical resident 100 years in the future. Therefore, residual hazardous or radioactive contaminants may remain after remediation, precluding immediate unrestricted land use. In addition, institutional controls will apply. Five-year reviews will be conducted for remediated sites, and institutional controls will remain in place until it is determined during a five-year review that controls and reviews are no longer necessary.

As discussed above, institutional controls will be implemented to manage the residual contamination at nine additional sites in WAG 5. These sites will also be subject to five-year reviews. Controls such as access restrictions will be maintained until it is determined during a five-year review that controls are no longer necessary. The status of these sites will be examined during the five-year reviews for WAG 5 to ensure that site conditions have not changed significantly and that the status of each site remains consistent with the WAG 5 ROD (DOE-ID 2000a). The reviews will include an assessment of maintenance requirements such as subsidence and drainage repairs. Table 3-1 and Appendix A summarize the current status of controls at the 15 institutional control sites. Appendix B contains maps of each site within ARA and PBF.

4.2 Status of Remedial Activities

The remedial action for WAG 5 has been divided into two phases. Phase I was specific to tanks and inactive waste systems located at ARA. In addition, remediation of the ARA-25 contaminated soil site was included in Phase I because of the proximity of the ARA-25 soils to the ARA-16 radionuclide tank's system components (i.e., piping and hot cell drains). Phase II is concerned with the remediation of contaminated soils located at both ARA and PBF.

The Phase I sites that have been remediated are ARA-02, ARA-16, and ARA-25 (a Phase II site remediated in Phase I). In addition, four inactive waste systems were closed as a best management practice. These inactive systems included ARA-07 (ARA-II seepage pit to the east [ARA-720A]), ARA-08 (ARA-II seepage pit to the west [ARA-720B]), ARA-13 (ARA-III sanitary sewer distribution box and septic tank [ARA-740]), and ARA-21 (ARA-IV test area septic tank and leach pit No. 2). The Phase I remedial activities commenced in 2000 and continued through 2001.

4.2.1 ARA-02 Sanitary Waste System

For ARA-02, the entire septic system was removed in accordance with the requirements of the ROD (DOE-ID 2000a). The seepage pit sludge was removed and disposed of, thus mitigating the human

health risk associated with this site. In situ measurement of the soil immediately underlying the seepage pit location demonstrated that the Cs-137 concentration remaining in the soil was 0.36 ± 0.13 pCi/g, which is below the remediation goal of 8.5 pCi/g at the 1E-04 human health risk concentration for the residential 100-year scenario decayed through the exposure period. To note, the 8.5 pCi/g remediation goal for Cs-137 at ARA-02 is associated with the sludge waste and is not to be confused with the 23.5 pCi/g remediation goal for the surficial soils associated with ARA-23. The Cs-137 concentration remaining in the soil is also below the average Cs-137 concentration of 0.82 pCi/g for the INEEL at the 95% upper confidence limit for the mean soil concentration averaged over a 3-m (10-ft) soil interval (Rood, Harris, and White 1996). Using Cs-137 as a marker and assuming the concentrations of the other contaminants of concern are present at the same ratio as the maximum concentrations provided in Table 21 of the ROD (DOE-ID 2000a), the concentrations of the remaining contaminants were derived as provided in Table 4-1. Based upon comparison of the postremediation concentrations to the remediation goals, the remediation of the ARA-02 site was determined to be successful.

Table 4-1. ARA-02 contaminant concentrations.

Contaminant of Concern	Maximum Concentration prior to Remediation	Remediation Goal	Postremediation Concentration
Cs-137	178 pCi/g	8.5 pCi/g	0.36 pCi/g
Ra-226	89.6 pCi/g	1.2 or 2.1 pCi/g[a]	0.18 pCi/g
U-235	120 pCi/g	6.2 pCi/g	0.24 pCi/g
U-238	190 pCi/g	10.6 pCi/g	0.38 pCi/g
Aroclor-1242	23.5 mg/kg	1 mg/kg	0.05 mg/kg
Lead	1,290 mg/kg	400 mg/kg	2.61 mg/kg

a. A goal of 2.1 pCi/g will be used for comparison of sample results that may include interference from U-235; otherwise, a goal of 1.2 pCi/g will be used. Since U-235 is present at this site, the use of the 2.1-pCi/g remediation goal would be appropriate even though the postremediation concentration is well below either of the two Ra-226 remediation goal concentrations.

4.2.2 ARA-16 Radionuclide Tank

For ARA-16, the waste was removed from the tank; and the tank, its associated piping, and the concrete vault were removed in accordance with the requirements of the ROD (DOE-ID 2000a). In situ measurement of the basalt/soils underlying the tank and vault demonstrated that the maximum Cs-137 concentration remaining was 1.5 pCi/g, which is below the remediation goal of 23 pCi/g at the 1E-04 human health risk concentration for the residential 100-year scenario decayed through the exposure period. Some low levels of Cs-137 contamination remain in the surficial soils overlying the ARA-16 site; however, this contamination is attributed to windblown spread of contamination from ARA-23 rather than originating from the ARA-16 site. Because the remaining contaminant concentration attributed to ARA-16 is below the remediation goal, the remediation of the ARA-16 site was determined to be successful.

4.2.3 ARA-25 Contaminated Soils

For ARA-25, the contaminated soils were removed in accordance with the requirements of the ROD (DOE-ID 2000a). In addition, the hot cell foundation was also removed, allowing excavation of the underlying and immediately surrounding soil to basalt. In situ measurement of the basalt layer

demonstrated that the maximum Cs-137 concentration remaining was 398 pCi/g, which exceeds the remediation goal of 23 pCi/g at the 1E-04 human health risk concentrations for the residential 100-year scenario decayed through the exposure period. As with the ARA-02 site, the Cs-137 was used as a marker to calculate the concentrations of the remaining contaminants based upon the ratio of their maximum concentrations to that of Cs-137, as obtained from Tables 13 and 14 in the ROD (DOE-ID 2000a). The concentration of Cs-137 and those derived for the other contaminants of concern are provided in Table 4-2. Although the remaining contaminant concentrations exceed the remediation goal, Section 8.6 of the ROD (DOE-ID 2000a) stipulated that remediation goals can be satisfied by either cleaning up to the identified contaminant concentration or by removing all soil down to the basalt interface. Because the contaminated soils were removed down to the basalt interface, the remediation of the ARA-25 site was determined to be successful. However, because contamination does remain at the site, institutional controls will be required.

Table 4-2. ARA-25 contaminant concentrations.

Contaminant of Concern	Maximum Concentration prior to Remediation	Remediation Goal	Maximum Postremediation Concentration
Cs-137	449 pCi/g	23 pCi/g	398 pCi/g
Ra-226	29.7 pCi/g	1.2 or 2.1 pCi/g[a]	26.3 pCi/g
Arsenic	40.6 mg/kg	5.8 mg/kg	36.0 mg/kg
Lead	1,430 mg/kg	400 mg/kg	1,266 mg/kg
Copper	227 mg/kg	220 mg/kg	201 mg/kg

a. A goal of 2.1 pCi/g will be used for comparison of sample results that may include interference from U-235; otherwise, a goal of 1.2 pCi/g will be used. Regardless of which remediation goal concentration is used for comparison, the postremediation concentration clearly exceeds either one.

4.2.4 Inactive Sites

The following inactive sites were closed as a best management practice.

4.2.4.1 ARA-07, ARA-II Seepage Pit to the East. The closure activities at the ARA-07 seepage pit included removal and disposal of the chain-link fencing, roof structure, and top two courses of cinder blocks. These materials were surveyed for radiological contamination and taken to the bulky waste landfill at the Central Facilities Area (CFA) for disposal. A single radioactive particle was found on the roof structure and was determined to be a beta-emitter, most likely strontium-90, at 10,000 counts per minute. Radiological control personnel disposed of the particle as radiologically contaminated waste in accordance with INEEL procedures, as outlined in the INEEL *Radiation Protection Manual* (PRD-183). The seepage pit was abandoned according to Idaho Administrative Procedures Act (IDAPA) standards, as outlined in IDAPA 58.01.03.007, "Septic Tanks Design and Construction Standards." The backfilled excavation was then compacted and tested to verify that the compaction was at least 85% in accordance with the Construction Specification 02200, "Earthwork" (DOE-ID 2001a). As stated in the Phase I Remedial Action (RA) Report (DOE-ID 2002), institutional controls will be required at the ARA-07 site because of residual Cs-137 remaining in the seepage pit soils.

4.2.4.2 ARA-08, ARA-II Seepage Pit to the West. The closure activities at the ARA-08 seepage pit included excavating the site followed by removing, sizing, and disposing of the three concrete lids covering the seepage pit. The radiological survey of the lids did not reveal any radiological

contamination, allowing the lids to be dispositioned as conditional industrial waste in the CFA landfill. Clean backfill was hauled to the site and placed inside the seepage pit along with the soils excavated from the top of the seepage pit. The seepage pit was abandoned in place according to IDAPA standards, as outlined in IDAPA 58.01.03.007, "Septic Tanks Design and Construction Standards." The backfilled excavation was then compacted and tested to verify that compaction was at least 85% in accordance with Construction Specification 02200, "Earthwork" (DOE-ID 2001a). As stated in the Phase I RA Report (DOE-ID 2002), institutional controls will be required at the ARA-08 site because of residual Cs-137 remaining in the seepage pit soils.

4.2.4.3 ARA-13, ARA-III Sanitary Sewer Leach Field and Septic Tank. Based upon analytical data collected prior to closure activities, it was determined that the liquid contents of the septic tank (estimated 8,706 L [2,300 gal]) were not hazardous; therefore, the liquid was pumped and transferred to the CFA sanitary sewer system. The septic tank and distribution box were excavated to allow access to the sludge in the bottoms of the components. Upon excavation, the septic tank, which was depicted as a three-chamber tank in the As-Built Drawings, was found to be three separate tanks in series. The top halves of each tank were removed, and dry cement and Aquaset were mixed into the sludge to stabilize any free liquids. The sludge from the septic tanks was then removed, placed into soft-sided containers, and disposed of at the Radioactive Waste Management Complex (RWMC). The sludge from the distribution box, identified as a waste regulated under the Toxic Substances Control Act (TSCA) because of the presence of PCBs, was removed, mixed with dry cement to stabilize any free liquids, and disposed of at Envirocare. The tops of the septic tanks were surveyed and found to be free of radioactive contamination. As such, they were shipped to the CFA landfill for disposal. The ARA-13 system components remaining in the ground were then decontaminated, visually inspected, and surveyed for radiological contamination using standard radiological control survey techniques, as outlined in the INEEL *Radiation Protection Manual* (PRD-183). No radiological contamination was detected. The components were abandoned in place according to IDAPA standards, as outlined in IDAPA 58.01.03.007, "Septic Tanks Design and Construction Standards." Holes were drilled in the bottom of each component, and each component and the excavation were filled with earthen material.

4.2.4.4 ARA-21, ARA-IV Test Area Septic Tank and Leach Pit No. 2. Based upon analytical data collected prior to closure activities, it was determined that the liquids contained in the septic tank and chlorination tank contained no detectable man-made radionuclides, nor were they characterized as being hazardous or classified as TSCA regulated. The contents of the tanks (estimated between 1,893 and 3,785 L [500 and 1,000 gal]) were pumped from the tanks and transferred to the CFA sanitary sewage system for disposal. The metal manholes, piping, and lids from the tanks were excavated, removed, and dispositioned in the CFA landfill. Holes were placed in the bottoms of the tanks, and the tanks were filled with clean earthen material and abandoned in place in accordance with IDAPA standards, as outlined in IDAPA 58.01.03.007, "Septic Tanks Design and Construction Standards."

4.3 Institutional Controls

The following subsections discuss the institutional control requirements for each of the three Phase I sites remediated under the ROD (DOE-ID 2000a). In addition, institutional controls are discussed regarding the four sites that were closed as part of the Phase I activities.

4.3.1 ARA-02 Sanitary Waste System

As per the ROD (DOE-ID 2000a), institutional controls will not be required at ARA-02 following remediation if all contaminated sludge is removed to basalt or if contaminant concentrations are comparable to local background values for soil. This holds true if any residual radiological contamination at the interface is below the concentrations that would be present following decay for 100 years. The

remedial action was successful in removing all of the contaminated sludge. Furthermore, the postremediation concentrations of the contaminants of concern are below the remediation goal for the site. For the radionuclide contaminants, the remediation goal concentrations that are based on the 100-year scenario must be adjusted for decay to current day. Table 4-3 provides a comparison of the remediation goal concentrations adjusted for decay to existing concentrations of the radionuclide contaminants of concern.

Table 4-3. ARA-02 decay-corrected remediation goals.

Contaminant of Concern	Remediation Goal	Decay-Corrected Remediation Goal	Postremediation Concentration
Cs-137	8.5 pCi/g	0.85 pCi/g	0.36 pCi/g
Ra-226	1.2 or 2.1 pCi/g	1.15 or 2.01 pCi/g[a]	0.18 pCi/g
U-235	6.2 pCi/g	6.2 pCi/g	0.24 pCi/g
U-238	10.6 pCi/g	10.6 pCi/g	0.38 pCi/g

a. A goal of 2.1 pCi/g will be used for comparison of sample results that may include interference from U-235; otherwise, a goal of 1.2 pCi/g will be used. Since U-235 is present at this site, the use of the 2.1-pCi/g remediation goal would be appropriate even though the postremediation concentration is well below either of the two Ra-226 remediation goal concentrations.

Based upon the postremediation concentrations of the contaminants of concern being below both the remediation goals as well as the decay-corrected remediation goals, institutional controls at the ARA-02 site are not required. In accordance with Section 8.1 of the Phase I RA Report (DOE-ID 2002), the institutional controls will remain in place until discontinued as a result of the five-year review process. There exist areas of surficial soil contamination where the concentrations of Cs-137 are elevated. This contamination is attributed to ARA-23 and will be addressed under the Phase II remedial activities.

4.3.2 ARA-16 Radionuclide Tank

For ARA-16, the concentration of Cs-137 remaining in the soils at the basalt interface underlying the tank had a maximum concentration of 1.5 pCi/g. This is below the remediation goal of 23 pCi/g that equates to a future concentration of 2.3 pCi/g for Cs-137 after 100 years of radioactive decay. Although the concentration of Cs-137 in the soils exceeds the background concentration of 0.82 pCi/g, the requirement has been met to remove soils to the basalt. Given that fact, along with the remaining contamination being below the calculated current risk-based concentration, institutional controls at the ARA-16 site are not required. In accordance with Section 8.1 of the Phase I RA Report (DOE-ID 2002), the institutional controls will remain in place until discontinued as a result of the five-year review process. As with ARA-02, Cs-137 is present in surficial soils attributed to windblown contamination as a result of the SL-1 accident. These soils will be addressed as part of the Phase II remedial action for ARA-23.

4.3.3 ARA-25 Contaminated Soils

For ARA-25, soils were removed to the basalt. However, the concentrations of most of the contaminants of concern were elevated above the remediation goals, as well as the risk-based concentrations. Although the ROD (DOE-ID 2000a) requirement has been met in terms of removal of contaminated soils to basalt, contamination remains at the basalt interface with a maximum concentration of 398 pCi/g for Cs-137. As such, institutional controls at the ARA-25 site will be required for approximately 224 years. As outlined in Table 3-2 of the *Operations and Maintenance Plan for Power*

Burst Facility and Auxiliary Reactor Area, Operable Unit 5-12 (DOE-ID 2000b), institutional controls at the ARA-25 site will consist of the following:

- Visible access restrictions—CERCLA sign
- Prevention of unauthorized access—INEEL security gate.

In addition, a monument will be installed marking the location of subsurface contamination remaining at the site.

4.3.4 Closure Sites

In accordance with the ROD (DOE-ID 2000a), institutional controls are not required at any of the four sites that were closed during the Phase I activities (i.e., ARA-07, ARA-08, ARA-13, and ARA-21). Based upon results of the closure activities and information presented in the *Waste Area Group 5, Operable Unit 5-12 Comprehensive Remedial Investigation/Feasibility Study* (Holdren et al. 1999), no evidence exists that would indicate institutional controls at any of these sites are warranted.

Based upon the analytical data obtained for ARA-13 and ARA-21 during Phase I, this determination holds true for these sites. However, based upon historical analytical data for the ARA-07 and ARA-08 sites, residual Cs-137 contamination exists that warrants institutional controls being established at these two sites. For ARA-07 and ARA-08, the historical Cs-137 maximum concentrations were 17.6 pCi/g and 11.6 pCi/g, respectively. These analyses were performed in June 1991; thus, the decay-corrected Cs-137 concentrations for ARA-07 and ARA-08 are 13.8 pCi/g and 9.1 pCi/g, respectively. These concentrations exceed the current concentration of 2.3 pCi/g required for free release; therefore, institutional controls will be required in accordance with the Phase I RA Report (DOE-ID 2002). The institutional controls will consist of visible access restriction (i.e., CERCLA signs) and prevention of unauthorized access (i.e., the INEEL security gate). The requirement for institutional controls at these two sites will be reviewed every five years.

5. DISPOSITION STATUS OF WAG 5 REMEDIATION WASTES

Various wastes resulted from the remediation of the Phase I sites. Many of the waste streams have already been disposed of at various facilities such as the RWMC, the CFA landfill, and Envirocare for solid wastes. Some solid wastes have been grouted and shipped to the Staging and Storage Annex (SSA) for eventual disposal in the ICDF. The liquid wastes generated have been disposed of at either the CFA Sewage Treatment Plant or stabilized and shipped to the SSA for eventual disposal in the ICDF. Still other wastes are in storage at the CERCLA Waste Storage Unit, located at the ARA-I facility, awaiting shipment for final treatment and disposal. Table 5-1 summarizes the wastes generated during the Phase I remediation activities, including current disposal status. This table will be updated annually with the submittal of the updated institutional controls status report and will reflect the disposition of the various waste streams at the time. The table also includes the TSCA-regulated sludge that originated from the ARA-02 Septic Tank 2 and is being stored until an approved off-Site treatment and disposal facility is available to take it.

Table 5-1. WAG 5 waste summary.

Waste Stream	Volume	Disposal Site	Disposal Status
ARA-02: ARA-I Sanitary Waste System			
Seepage pit sludge	Seven 208-L (55-gal) drums (3,166 lb)	Envirocare	Disposed 12/2000
Septic Tank #2 sludge	Nine 208-L (55-gal) drums (3,870 lb)	Permafix	Stored at CRECLA storage unit at ARA-I. Shipment planned 11/2002
Debris	Thirteen 1.2 × 1.2 × 2.4-m (4 × 4 × 8-ft) metal boxes (77,165 lb)	Envirocare	Disposed 12/2000
Debris	Nine 0.6 × 1.2 × 2.4-m (2 × 4 × 8-ft) wood boxes (32,530 lb)	Envirocare	Disposed 12/2000
Debris	One 1.2 × 1.2 × 2.4-m (4 × 4 × 8-ft) wood box (4,000 lb)	Permafix	Stored at CERCLA storage area at INTEC. Shipment planned 11/2002
Debris	Three 1.2 × 1.2 × 2.4-m (4 × 4 × 8-ft) TX4 boxes (17,860 lb)	Envirocare	Disposed 12/2000
Debris	Three 208-L (55-gal) drums (636 lb)	Envirocare	Disposed 12/2000
Debris	Three 18 yd^3 roll-offs (93,860 lb)	Envirocare	Disposed 12/2000
Debris	One 25 yd^3 roll-off (29,130 lb)	Envirocare	Disposed 12/2000

Table 5-1. (continued).

Waste Stream	Volume	Disposal Site	Disposal Status
Debris	One 1.2 × 1.2 × 2.4-m (4 × 4 × 8-ft) B-25 metal box (410 lb)	Envirocare	Disposed 12/2000
Debris	Eight 208-L (55-gal) drums (1,674 lb)	Permafix	Stored at CERCLA storage area at INTEC. Shipment planned 11/2002
Lead rings	Four 19-L (5-gal) drums (314 lb)	Permafix	Stored at CERCLA storage area at INTEC. Shipment planned 11/2002
Sample returns	Three 208-L (55-gal) drums and three 19-L (5-gal) pails (133 lb)	To be determined	Stored at Mixed Waste Storage Facility at the Waste Reduction Operations Complex
ARA-07: ARA-II Seepage Pit to east (ARA-720A)			
Debris	4.3 m^3 (5.6 yd^3)	CFA landfill	Disposed 07/2000
ARA-08: ARA-II Seepage Pit to west (ARA-720B)			
Debris	2.3 m^3 (3.0 yd^3)	CFA landfill	Disposed 07/2000
ARA-13: ARA-III ARA-III Sanitary Sewer Leach Field and Septic Tank (ARA-740)			
Septic tank sludge	One soft-sided sack (20,000 lb)	RWMC	Disposed 06/2001
Distribution box sludge	One 208-L (55-gal) drum (350 lb)	Permafix	Stored at CERCLA storage area at INTEC. Shipment planned 11/2002
Water	21,198 L (5,600 gal)	CFA Sewage Treatment Plant	Disposed 05/2001
Debris	One 12-yd^3 dump truck	CFA landfill	Disposed 05/2001
Debris	Two 208-L (55-gal) drums (205 lb)	RWMC	Disposed 05/2002
ARA-16: ARA-I Radionuclide Tank			
Piping	Five 0.6 × 1.2 × 1.8-m (2 × 4 × 6-ft) metal boxes, grouted	Stored at SSA for disposal at ICDF	Shipped to SSA 08/2001 through 09/2001
Tank	1.4 × 1.4 × 4.0-m (4.5 × 4.5 × 13-ft) concrete monolith	Stored at SSA for disposal at ICDF	Shipped to SSA 04/2002

Table 5-1. (continued).

Waste Stream	Volume	Disposal Site	Disposal Status
Sludge	High-integrity container with 303 L (80 gal) liquid and sludge	To be determined	Stored at CERCLA storage unit at ARA-I
Stabilized liquid	Nineteen 208-L (55-gal) drums	Stored at SSA for disposal at ICDF	Shipped to SSA 09/2001
Carbon filter	One 20 × 60-in. unit (6 ft^3 of carbon)	Permafix	Stored at CERCLA storage unit at ARA-I
Miscellaneous debris	Nine 0.6 × 1.2 × 1.8-m (2 × 4 × 6-ft) metal boxes, grouted	Storage at SSA for disposal at ICDF	Shipped to SSA 09/2001
Vault and gravel	Two soft-sided sacks (20,000 lb each)	RWMC	Disposed 10/2001
ARA-21: ARA-IV Test Area Septic Tank and Leach Pit No. 2			
Water	3,785 L (1,000 gal)	CFA Sewage Treatment Plant	Disposed 10/2000
ARA-25: ARA-I Soils beneath the ARA-626 Hot Cells			
Debris	Thirty-nine soft-sided sacks (20,000 lb each)	RWMC	Disposed 08/2001 through 09/2001

6. REFERENCES

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